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Transport Canada
Safety and Security

Transports Canada
Sécurité et sûreté

Civil Aviation / Aviation civile
Aircraft Certification Branch / Certification des aéronefs
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Your file *Votre référence*

Our file *Notre référence*
NPRM 99-18

April 7, 2000

Federal Aviation Administration
Attention: Michael E. Dostert,
Propulsion/Mechanical/Crashworthiness Branch
ANM-112, Transport Airplane Directorate
1601 Lind Avenue SW.
Renton, WA 98055-4056

Subject: NPRM 99-18: Transport Airplane Fuel Tank System Design Review, Flammability Reduction, and Maintenance and Inspection Requirements; AC 25.981-1X: Fuel Tank Ignition Source Prevention Guidelines; and AC 25.981-2X: Fuel Tank Flammability Minimization

Federal Register Volume 65, No. 22, dated February 2, 2000, and No. 32, dated February 16, 2000 gave notice on the availability of the subject and invited interested persons to submit their comments to the FAA. In response thereto, Transport Canada is pleased to offer, for your consideration, the comments contained in the attachment to this letter. These comments are submitted within the commenting period as agreed to in the e-mail from Mike Dostert, FAA, to Bastien Dufour, Transport Canada, dated 09 Mar 2000 4:48 PM.

Sincerely,

Maher Khouzam
Chief, Regulatory Standards
Aircraft Certification

Attachment: as stated

TRANSPORT CANADA COMMENTS
ON THE FAA NOTICE OF PROPOSED RULEMAKING ON
"TRANSPORT AIRPLANE FUEL TANK SYSTEM DESIGN REVIEW,
FLAMMABILITY REDUCTION, AND MAINTENANCE AND INSPECTION
REQUIREMENTS", NPRM 99-18, AND RELATED AC'S 25.981 - 1 X AND 25.981-2X

1. This document includes the comments from Transport Canada on the Notice of Proposed Rulemaking on "Transport Airplane Fuel Tank System Design Review, Flammability Reduction, and Maintenance and Inspection Requirements", NPRM 99-18. It also addresses the related Advisory Circulars AC 25.981-1X and AC 25.981-2X. First, general comments are made which apply to the NPRM as a whole; they address the philosophy behind NPRM 99-18. Then, specific comments are made to parts of NPRM 99-18.

General comments

2. Transport Canada supports the intent of the proposed rule to improve fuel system safety standards and to eliminate features shown to be undesirable for existing aircraft.

3. The range, depth and interdependence of the fuel system issues associated with NPRM 99-18 are truly considerable. The impacts are worldwide. It is deeply believed that coordinating among all the stakeholders and harmonizing among Civil Aviation Authorities is required to efficiently improve fuel tank safety and adequately serve the flying public. This cannot be over-emphasized. While it is much appreciated that Transport Canada, and other interested parties worldwide, have been given the opportunity to comment on the NPRM, it was quickly concluded that such an approach makes it difficult for commentators to efficiently contribute to the solutions that will have worldwide effects. This is due, among other things, to the fact that commentators must make assumptions as to the meaning of the wording in the NPRM while not having direct access to all of the information that is available to the FAA. For example, the TWA 800 accident investigation has been identified as the catalyst for NTSB to request of the FAA that immediate retroactive changes be made to existing aircraft and new designs. Since this Information thus far is privileged, other Civil Aviation Authorities are at a disadvantage to determine if similar actions are required and prevents our normally open exchange of views through harmonization activities. Transport Canada has been participating in the Air Transport Association Fuel System Safety Leadership Team activities which, in the absence of a formal harmonization activity, has become a crucial forum to exchange information among those that will be affected by the content of the NPRM. It is believed that a more appropriate avenue to achieve this coordination is the ARAC Harmonization Work Program (HWP) which helps ensuring that regulations impacting both domestic and foreign parties do not require parties to operate or manufacture to different standards for each country involved. Given the multiple interests at stake and the international impact of the proposed rules, it is requested that the FAA, beyond the NPRM consultation process, considers establishing coordination activities, whether through

the ARAC HWP or other means, with Transport Canada and the JAA to finalize the proposed rules and AC's. It would also allow for discussion of some aspects of their implementation like, for example, the kind of assistance, if any, that the FAA might seek from other Civil Aviation Authorities for the implementation of the SFAR. In this fashion, the details of the proposal can be efficiently discussed and debated, in an active, multi-directional exchange of information. The alternative approach used herein (commenting on the NPRM) is a less dynamic, unidirectional exchange of information which, it is believed, might limit the quality of the final rules.

5. The reasons and the objectives of the rules should be stated more clearly. The text under "Reasons why the FAA is considering the proposed rule" identifies an objective, not the reasons. The reasons are as stated in the Summary i.e. degradation of design safety features intended to preclude ignition of vapors within the fuel tank. Furthermore, the objective phrased as "prevent airplane explosions and the resultant loss of life" should be rearranged to read "prevent the loss of life due to airplane explosions". The difference allows to logically consider the mitigation of the ignition of fuel vapors (i.e. ignition or even explosion does occur but continued safe flight and landing is possible) as acceptable, as intended by proposed §25.981(c)(2). Restating the objective in that fashion can in fact be an important step in stimulating creativity and bringing about innovative solutions from the stakeholders now or many years from now when applicants and regulators look into the preamble to determine the intent (objective) of these rules.

6. Fuel system design has been based on the assumption that the ullage fuel/air mixture is always flammable. The NPRM, page 47, indicates that the FAA has retained this assumption for now but seems to indicate a willingness to eventually entertain designs that would rely more on flammability minimization and mitigation, potentially allowing designers to assume the absence of a flammable ullage under certain conditions. It is felt that that affordable technology is remote and therefore it should be made clear that the design philosophy behind the proposed §25.98 1 has firmly retained the assumption of flammable ullage.

Specific comments

7. *Type Certificate Amendments Based on Major Change in Type Design, page 12, and Field Approvals.* Modifications approved under a field approval are discussed under the NPRM but it is felt that they should be discussed in more details; as a matter of fact, they have not even been accounted for in the economic evaluation. The field approval does not have the same visibility as an STC and it could be substantially more difficult to identify which ones have affected the fuel systems. Furthermore, many might have been approved by the inspector without certification engineering analysis and data, complicating the design review analysis required by the SFAR. Such modifications are of interest even to foreign parties as they might have been incorporated on aircraft that are now on foreign registries. It is requested that the FAA provides more details as to how it intends to apply the SFAR to the

modifications approved under a field approval.

9. *Unforeseen Fuel Tank System Failures, Page 21. The* proposed NPRM references the issue of arcing in fuel probes as a possible ignition source. It is stated that certain kinds of conductive debris placed in fuel quantity probes may cause arcing from induced currents or shorting. This was established by test and not based on an actual occurrence. It is therefore difficult to equate this to an unforeseen failure. Note that such conditions are possible on virtually all other aircraft systems where intentional contamination may be introduced. Furthermore, three "design anomalies" are referenced (page 23) as possible ignition sources : "objects from a fuel pump inlet diffuser" ingested into the fuel pump, worn override/jettison pump inlet adapters with possible sparking of steel parts and improper design of an auxiliary fuel tank causing electrostatic charging of foam with subsequent fuel tank ignition. It is not clear how prevalent these kinds of failure conditions are within large aircraft fuel systems generally, or whether it is practical to try and anticipate these kinds of failures at the design stage. Since these failures are identified as unanticipated and attributed to design anomalies they are therefore no different from conditions affecting all parts of the aircraft which are subjected to the effects of wear.

10. *Safety Review, page 32.* It is impossible to show that "fuel tank fires or explosions will not occur", as the probability of such an event, in terms of system safety analysis, cannot be shown to be equal to zero. And it is believed that it is not what the FAA meant. This phrase should be removed as the essence of the requirement is captured in the sentence following (showing compliance with the proposed standards). Alternatively, the intent of the regulation could be clarified to require practical elimination of ignition sources with the intent to eliminate of all sources by use of new technology and design architecture.

11. *Applicability of the proposed SFAR, page 35, and repairs.* The design review should be applicable to the repairs that have been incorporated already, but the SFAR seems to omit these repairs. It is believed that it could be very difficult to trace back all the repairs, not to mention their supporting engineering data, so that a proper safety analysis could be carried out. It is believed that repairs, as for orphan STC's, might render the design review by safety analysis approach unworkable in many cases. To help the operators, the manufacturers should be required to provide for an alternative to the safety assessment.

12. *Supplemental Type Certificate (STC), page 3 7 and access to manufacturer design data.* A significant portion of the SFAR activity is related to modifications and repairs conducted post delivery. Manufacturers have made significant engineering investments related to their proprietary design standards and means/methods of compliance. This information is not always provide for public knowledge. Since the company design standards are not known and thereby may not be maintained by modifiers the integrity of the finding of compliance can not be assured. Existing STC/Repair process puts the onus on the modifier or person installing to ensure

compliance is not compromised with the installation or repair. Given that the modifier does not have this information there should be specific guideline written to either preclude the work in sensitive areas or have a common industry standard that the modifiers will use and the Manufacturers are aware of when working in these areas.

14. *Supplemental Type Certificates (STC) without a current holder and Compliance, pages 37-39.* STC's of which the holder no longer exists ("orphan" STC's) and for which the operators would become responsible can present at least two difficulties. First, the data might not be available to conduct a safety review as required by the NPRM. An alternate means conducting a safety review should be identified. Second, most of the operators will not have the engineering resources to carry out the required design reviews and will have to hire engineering services. It might become apparent , once the number of orphan STC's and the availability of qualified engineering consultants are better assessed, that there is not enough resources to do the work within the time frame allowed. To cater to such a situation, the FAA should consider imposing a longer compliance time, depending on the risk associated with the particular STC's.

15. *Compliance, page 38.* The amount of time proposed for completion of the safety review and any maintenance or inspection instructions which may have to be developed from it, appears restrictive. It is felt that the associated scope of work might not allow both the affected design approval holders and the FAA to timely complete the tasks at hand. This is a concern for foreign authorities because they would be facing the same difficulties in the likely event that similar rules are adopted, resulting in greatly dissimilar time compliance from country to country. This is not the level playing field that the current harmonization effortsaim at.

16. *Proposed Operating Requirements, pages 39 and 42.* It is not understood what is meant by "a specified compliance time". It is understood to be 18 months but if this addresses some other portion of the process, if should be clarified.

17. *SFAR No.XX, Compliance, pages 78-79.* Transport Canada believes the review should be consistent with the kind of System Safety Assessment conducted at the time of certification (e.g. pre- or post- amendment 25-23 which introduced §25.1309). Re-evaluation of older aircraft types with today's methodologies using more quantitative versus qualitative analysis could present insurmountable difficulties given data unavailability and the resources required.

18. *§ 25.981 (a) and total elimination of ignition sources.* It is very difficult to show that "no ignitions source may be present" unless all the possible means to introduce an ignition source are eliminated. This would preclude all wiring within the tanks, hydraulic heat exchangers, submerged motors (over temperature protection can not be considered 100% reliable) and no loss or deterioration in bonding. The required bonding would require comprehensive maintenance program at an appropriate inspection interval.

19. *§25.981 (a) (I) and (2), and autoignition temperature. The* new wording for §25.98 1 is not substantially different from the existing wording of 25.981 however the overall effect of the revision places more emphasis on the required use of the fuel property "autoignition temperature" in fuel tank design. Indeed, the current text 25.98 1 (b) states: " No temperature . . . .tmay exceed the emperature determined under paragraph (a) . . . . This must be shown . . . ". The NPRM proposed text states: " no temperature ..... will exceed the temperature determined under paragraph (a). This must be verified ...". The replacement of "may" and "shown" with the stronger wording "will" and "verify" implies more emphasis on this issue. While such an increased emphasis is deemed appropriate, it leads to a concern with respect to the availability, to the aircraft manufacturers, of the fuel autoignition temperature specifications. The autoignition temperature property may not be specified nor controlled by the fuel manufacturer. Therefore, the concern is that the design of the aircraft is regulated with a dependence on a property of fuel that is not available. It might be difficult to convince the petroleum industry to consider specifying and controlling additional properties such as autoignition temperature because, among other reasons, it may be argued that it is a difficult property to measure. It would require that a standard test procedure (such as ASTM E659) be agreed upon and used by the fuel manufacturers, -- which would allow the aerospace industry to specify the maximum allowable fuel tank surface temperature for which their fuel is approved.

20. Alternatively, aircraft manufacturers will have to continue to accept that there will be a variation in fuel specifications (including autoignition temperature) and cater for it by design. Currently, the generally accepted aircraft design practice is to keep the fuel tank surface temperature below 400 °F. It is believed that this value, when it was established, did not take into account other factors such as vibration, fuel load, composition of fuel vapors in the ullage space during the various phases of flight, fuel enhancements such as anti-icing additives, etc. Therefore, a new generic minimum fuel autoignition temperature value could be established taking into account the aircraft specific considerations discussed above. This new value could then be used as a guidance material by the aerospace community.

21. *§ 25.981(a)(2) and heat transfer.* It is recommended that the FAA considers the alternative to have the industry determine an acceptable heat transfer rate at a critical fuel load rather then determining if a temperature limitation is exceeded given that the tank ullage is considered flammable. This would alleviate the difficulties of working with a high number of parameters inherent to the numerous aircraft types and conditions (including the effects of pumping, vibration, altitude, fuel load, etc.) by rather considering a generic installation.

22. *§25.981(a)(3) andsafety assessment as per §25.1309.* Assessment of the effects of failure conditions are presently conducted in accordance with methodology identified in AC 25.1309-1A and as amended by the present Harmonization Working Group activity. Evaluation of all failures should be consistent when considering all aircraft

hazards. Effect of the various factors identified are normally considered when conducting the system safety assessment, component qualification and MSG-3 analysis. Therefore, specific criterion for fuel system does not seem appropriate.

24. *§25.981(b) and CMR's.* The concept of a declaring "critical configuration control limitations" is unique and believe to be unnecessary if the FAA was to formally recognize the Certification Maintenance Requirements (CMR) concept which identifies aircraft system related safety tasks for dormant failure conditions related to hazardous and catastrophic failure conditions. The CMCC process identified in AC 25-19 can be used to allow operators to absorb tasks within the existing maintenance programs if a MSG-3 task is identified thus reducing costs associated with tracking additional Airworthiness Limitations.

25. *§25.981 (b) and identification of critical design configuration limitations. The* manufacturers of the aircraft have developed means and methods of compliance to ensure that regulations are satisfied which are communicated in proprietary design manuals. Maintenance program for the aircraft will ensure conformity to the design is maintained and thus compliance is preserved. It is Transport Canada's opinion that the requirement for manufacturers to identify all critical areas by visual means has significant design compliance burden that does not provide a safety improvement other then providing information for the benefit of another party intending to modify or repair the aircraft. Also, these additional feature become required by design and there would be an associated maintenance activity to ensure conformity. Transport Canada does support the need to identify sensitive wiring given that the industry does not have clear guidance to inform maintainers and modifiers of critical installations and precautions which lead to ad hoc wire routing. All other component installations are governed by the maintenance manual.